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1 2 3 4

1 Display for relay function
2 Descriptive text for displayed values
3 Digital value displays
4 Unit of display
5 Key for setpoint and parameter mode
6 Setpoint adjustment

certifications: DIN, GL, BV, DNV

5   6

General:

The universal controllers 93AM23 consist of a control part with preadjusted selectable functions. After reconfiguration to another function the stored parameters for each function are preadjusted automatically.

- VC 421: Continuous control with 2 additional contacts and 1 information signal output
- VC 521: Continuous control with 2 outputs working above the setpoint and 2 additional contacts and 1 signal output
- VC 622: Double continuous control switchable depending on the state of a binary input with 2 information signal outputs and 2 additional contacts

The transmissive colour TFT indication is easy to read in both light and dark environments. In operating mode up to 4 values (actual values, setpoint values, control settings, time ..) can be displayed including freely adjustable description text and unit of display as well as 9 displays for relay functions, optionally including freely adjustable description text. Additional displays for operating and malfunction messages with time stamp, including the corresponding hardware, and graphical real-time representation of actual- and setpoint values or custom display masks are available.

Measuring inputs / ranges:

ai1: Pt100 or standard signal, range 0...400°C resp. adjustable, preadjustment 4-20 mA / 0-50
ai2: Pt100 or standard signal, range 0...400°C resp. adjustable, preadjustment 4-20 mA / 0-200
ai3: Remote resistance transmitter or standard signal, preadjustment 4-20mA / 0-100

Binary input:

2 binary inputs, external voltage 0/24VDC or potential free contact
0V resp. contact open: status = 0; 24V resp. contact closed: status = 1
b1: (only with conf. = 622): 0 = control channel 1 active; 1 = control channel 2 active
b2: 0 = continuous output(s) = 0%; 1 = auto. control

Relay outputs:

4 relays with potential-free changeover contacts incl. spark extinction, switch. power 250V 2A, preadj.:
K1: limit comparator assigned to actual value 1
K2: limit comparator assigned to actual value 2
K3: off
K4: off

Analogue outputs:

4 signal- / continuous outputs 0/4..20 mA, galvanically isolated, preadjustment:

	VC 421	VC 521	VC 622
S1:	continuous Y1	continuous Y1	continuous Y1
S2:	actual value1	continuous Y2	actual value 1
S3:		actual value 1	actual value 2
S4:			

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Installation:

Before installation inspect the controller for any visible signs of damage caused during transport.
Check power supply acc. to name plate.
Push the housing from the front into the DIN- panel cut-out and secure from behind with the
fastening devices supplied.

Electrical wiring:

Plug bar on the back face of the controller; connect up the controller at the rear following the
wiring diagram; wire cross section max. 1,5 mm^2
- To avoid cross interference *all low voltage measuring lines and pilot wires* must be encased
 in a **shielded cable** (the shielding must be earthed one-sided).
- The control leads must be **fused** *externally* to protect the output relays.
- Phase wire and neutral wire must not be transposed.

Putting into operation:

Switch on power supply. Digital display and control lamps (if available) will light up according to
the setpoint after some seconds. If nothing happens check the fine-wire fuse (if available) on
the back panel of the controller and the electrical wiring. Adjust set value and check other
adjustments.

Maintenance:

All electronic controllers in the product range of the manufacturer are virtually maintenance-free.
Provided that the controller is correctly installed and put into operation and is protected against
mechanical damage and inadmissible operating conditions, it should give years of trouble-free
service. *In case of faults* repair work by the customer should be restricted to the externally
accessible leads and connections and components the customer is expressly permitted to deal
with himself (bridge circuits, fuses).

*All further work, especially on internal components will terminate warranty, makes subsequent
inspection and fault repair more difficult and can cause considerable damage to the circuitry.*

For repair remittance remove plug board with connected leads on the rear side,
loosen fastening devices and remove controller from the panel.

In case of remittance please give precise details of the fault to reduce time and cost of repair.

Error messages:

Err 1...6	Fault on measuring input nr. ... check measuring lines for short circuit or breakage check measuring input by connecting a RTD
Err 55	Fault on loading the parameter; press any key, the controller starts in emergency operation mode, configuration of the parameters has to be checked
Err 50	Hardware error in program section
Err 52	Hardware error in data section no further operation possible, remit controller for repair
Err 58	Binary inputs out of function (status = 0), remit controller for repair
Err 59	Digital outputs out of function (switched off), remit controller for repair
Err 60	Relay outputs out of function (switched off), remit controller for repair
Err 61	Analogue outputs out of function (0 %), remit controller for repair
Err 62	Data connection to the modular fault detector 826.. interrupted, check cables
Err 63	Data connection to the hardware expansion modules interrupted, check cables

Error messages during self adaptation:

Err 202	Ambient conditions are not suitable for self adaptation; adjust parameter manually
Err 205	routine exceeded the setpoint raise setpoint or lower actual value and start adaptation again
Err 206	Fault on measuring input during adaptation; check the wiring and start adaptation again

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Operating status:
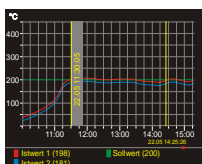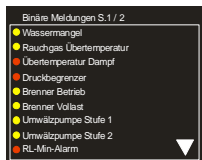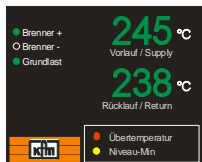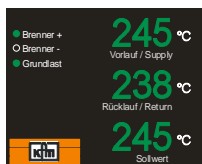
Analog values: Depending on the configuration, up to three values in 10 mm size or two values in 10 mm and two values in 3 mm size can be displayed. A dedicated unit for each value can be configured if desired. The corresponding descriptive texts are changeable by means of the PKS PC software.
Depending on equipment, the status of the relays is shown at the left side of the display via a coloured circle icon.

In conjunction with the option of binary input messages, the corresponding texts are shown in the two lower 3 mm display lines if the binary inputs are activated. The corresponding value displays are hidden during this time.

Message list#: *Briefly* press the △ - button (*do not* hold)
The display now shows a list of message texts for all activated binary inputs in the order of their occurrence. Operating messages are displayed by a circle icon coloured yellow. Messages which are configured to the collective relay are marked with a circle icon coloured red. This flashes until the message has been confirmed by means of binary input reset.

Graphical representation#: - *Briefly* press the △ - button (*do not* hold)
Actual- and setpoint values of the controller are displayed as a continuous diagram. The actual recording cycle is signalised by an ongoing red dot. Vertical yellow lines with grey background for date and time represent recording interruptions.

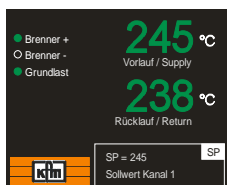*optional*: To switch on the cursor press 🅿 -button *briefly*:
The cursor is moved along the time axis with the ▽ (earlier) / △ (later)-*buttons*, the values of the cursor position are shown in accordance to the date and time.
- *briefly* press the 🅿 - button to switch off the cursor

Custom specific representations# : briefly press the △ - button each (*do not* hold)

Hint: The configuration of the graphical- and custom specific representation is possible with the PC- software WinPKS only, see 99pks manual.

Setpoint value setting: - *Briefly* press the 🅿 - button (*do not* hold)
A flashing frame with the description SP shows the activated setpoint level and the parameter name "SP=" the adjusted value as well as an description text optionally.

The displayed value can now be changed using the ▽ (lower) and △ (higher) *buttons*. A setpoint change is effective *immediately*, without any further operational steps. 'Arrow' button *acceleration effect: longer* pressing *causes faster* changing.

***return* to operating mode: briefly press the 🅿 - button (or automatic after > 30 sec)**

optional:
*SPB
*SP
 SP2 / 3 / ..
 SPE

SP-F

Briefly press the 🅿 - button again each time:
Bus setpoint, forced by an external bus adapter (e.g. 99spde..)
setpoints of additional control loops (*=no)
additional setpoints for the control loops
external setpoint (display only);
flashing description signifies: value is presently *not* active.
Switch over menu SP / SPE (only in case of adjustment SPEF=MENU (Conf-level))

Manual operation#:
Press and hold the ▽ -button, then additionally press the △ - button, then release both. (Option: *Switch on and off using the extra button* 🔲)
(*For multi-channel controllers, first select the channel number CH..
using the* ▽...△. *buttons and continue with the* 🅿 *-button, after which*:)

MAN.
The display shows "MAN. ", plus the setting variable, if it exists.
The control function is switched off.
Manual control is now possible using the ▽...△. buttons
return to operating mode: ***only*** with 🅿 -button (or. 🔲),
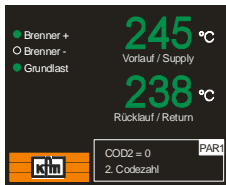*no* automatic switching back from manual operation!

Optional: Start self-optimisation (see chapter Optimisation):
press the 🅿 -button >5 sec whilst in manual control function;
the lower display jumps to "-Ad-". *Abort:* press the 🅿 -button again >5 sec

if existing

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Access from the operating level
After *polling* (see instructions for level PAR 1 / 2), a flashing frame with the description PAR1 / PAR2 shows the activated parameter level.
The *upper text display* shows the first parameter name and the adjusted value, the *lower text display* optionally shows a description text.

continue to the next parameter and/or *confirm* entry:
briefly press each time the 🅿 - button

To *change* the setting displayed: Press the 🔽...🔼 buttons

Settings in detail: *(existence depends on version and type):*

		Factory setting	Notes
PAR 1	Polling: press and hold the 🅿 - button >5 sec, release it after the display reacts.		
COD2	Code number 2 (password) for parameter levels (1…9999)	1	___
CH..	(only) for multi-channel controllers: Selection of desired channel (no.)		
P	Proportional range Xp (%) (for more details, see "Optimisation")	25.0	___
I	Integral action time Tn (min) (for more details, see "Optimisation")	7.0	___
D	Rate time Tv (min) (for more details, see "Optimisation")	0.2	___
SH	Response sensitivity ("dead zone") Xsh (%)	0.1	___
SA.	Setpoint distance (absolute) for following switching contact no.	5.0*	___
SP.	Independent setpoint for switching contact no.	0.0	___
SD.	Hysteresis (switching difference on/off) for switching contact no.	3.0	___
	Only with configuration time dependent additional contacts:		___
tSt.	Start time for switching contact no.., (weekday, hour, minute)	daily/0/0	___
tL.	Switching time for switching contact no.., (days, hours, minutes)	0/0/0	___

(..201,701/SA3 :10.0)*

return to operating mode:
briefly press the 🅿 - button (or automatic after > 30 sec)

		Factory setting	Notes
PAR 2	Polling: *press and hold the 🅿 - button, additionally press the 🔽 - button, hold both buttons for >5 sec, release them after the display reacts:*		
COD2	Code number 2 (password) for parameter levels (1…9999)	1	___
Time adj.	*Submenu* time adjustment, Polling: press and hold the 🅿 - button >5 sec.		
Date	Weekday, calendar day, month, year (actual selection marked white)	-	___
Time	Hour, minute, second (actual selection marked white)	-	___
Unit	Switches the unit of display (°C / °F), only temperature inputs	C	___
***BLO/*BHI**	(only) for voltage / current input: start / end of display range	#	___
***ELO/*EHI**	(only) for external setpoint: start / end of setpoint range	#	___
***SLO/*SHI**	(only) for information signal output: start / end of range	#	___
NST	Number of decimal places of the display (0 / 1 / 2, depending on range)	0	___
***Lo / *HI**	Setpoint setting range, lower / upper limit	#	
BRGH	Brightness Display (30 ... 100)	50	___
DSP1/2/3/4	Variable shown in display line 1-4 (10mm)(OFF/ SP/ Y/ IST*/ text**/ time**)	1=IST1	___
	Note: display line 1 to 3: 10mm, if DSP4 = "OFF"	2=IST2	___
	otherwise display line 1 and 2: 10mm, display line 3 and 4: 3mm)	3=SP	___
	(SP = setpoint,Y=setting var.,Ist*=actual value channel*/measuring input*)	4=OFF	___
EIN1/2/3/4	Unit of measurement for display line 1-4 (°C / °F / % / bar / mbar / mPas / cSt / Kgm3 / mm / Kpa / L / m3/h / " ") Note: no conversion!	°C/°C/°C	___
Text1/2/3/4	Desription text for corresponding display line1..4: choose from a	1= ACT.VAL1	___
	predefined list (ACT.VAL..,SETPOINT, SUPPLY,RETURN),	2= ACT.VAL1	___
	resp. 1 additionally editable text..✻,changeable by PKS-software	3= SETPOINT	___
DSPT	Configuration message text: TXT (messages in lines 3 and 4, value indication is deactivated),TXTL (messages list only),OFF	OFF	___
Hist.	*Submenu* delete history, Polling: press and hold the 🅿 - button >5 sec.		
Del	Delete history (NO / YES)	NO	

return to operating mode: *briefly press the 🅿 - button (or automatic after > 30 sec)*

* = ID number in case of several measuring inputs or control loops.   **# =** *corresp. range*
**=display line 4 only

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1. manual optimization

An optimum adaptation of the control parameters (P,I,D) is necessary in order to balance
an appearing deviation as quickly, non-oscillating and exactly as possible,
according to the given operating conditions.

Generally these adjustments require a lot of professional knowledge that cannot be replaced
by this brief information.
The following informations are for help purpose only:

P = proportional band Xp (%):
lower value *= longer* impulses, more sensitive reaction
higher value = *shorter* impulses, less sensitive reaction
    Examples: - Oscillating temperature without distinct initial overshot: Xp too low;
                - The setpoint is reached very slowly after initial exceeding: Xp too high.

I = integral action time Tn (min):
lower value= *shorter* impulse gaps, faster balancing
higher value= *longer* impulse gaps, slower balancing
    Examples: - the set value is reached very slowly without overshooting: Tn too high;
                - high initial overshot followed by fading oscillation: Tn too low.

D = rate time Tv (min):
increases the controller reaction in case of fast actual value or setpoint alterations
(adjust only if necessary). Higher values cause higher increase.

2. Self-adaptation

The self-adaptation is an automatic procedure that determines and self-adjusts
the optimum control parameters Xp, Tn and Tv.

Operation, if contained in supply schedule:
(Parameter-safety-switch on the rear panel of the controller (if available) has to be unlocked:
position "u")

Check starting assumptions:
Actual value at least 20% below the adjusted set value,(e.g.:heating phase), otherwise first:
Lower actual value adequately by manual operation (position of final control element) (quick circuits)
or increase setpoint adequately, if admissible. (faster procedure for slower circuits)

Call manual operation level: Press ▼ - key plus ▲ - key (optional: seperate key).
Check controller output: must not be higher than 85% , reduce if necessary.
Start self-adaptation: Hold down **P** - key for more than 5 sec. on manual operation level.
During operation the lower display shows: "-Ad-",
the upper display still shows permanently the actual value.

Information about computer operation: First the self-adaptation program waits for stabilization
of the actual value according to the given controller output (actual value alteration < 0,1% / min),
then it increases the output signal about 10% or, in case of three- point- step controller operation,
it triggers an output impulse with about 10% of the adjusted regulating time.
The optimum parameters are computed according to the unit- step response.

Cancel: Press **P** - key for more than 5 sec. = return to manual operation level

After successfully finishing the procedure the controller will return **automatically**
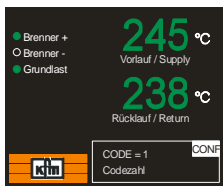to operating level.

Unsuccessful adaptation (Display shows error code, ref.to chapter error messages):
Press **P** - key again: Return to manual operation level
eliminate the indicated error
start adaptation again: **P** - key > 5 sec.
or return to operating level: **P** - key shortly

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Access from the operating level

Polling: press and hold the 🅿 *- button, additionally press the* 🔼 *- button,*
hold *both buttons for >5 sec, release them after the display reacts:*
A flashing frame with the description CONF shows the activated parameter
level. The *upper text display* shows the first parameter name and the
adjusted value, the *lower text display* optionally shows a description text.

continue to the next parameter and/or *confirm* entry:
briefly press each time the 🅿 - button

To *change* the setting displayed:
Number values: Press the 🔽...🔼 buttons, text values:press the 🔼 - button

Settings in detail:
(existence depends on version and type):   *Factory setting*   *Notes*

CODE	Code number for configuration level (1…9999),	1	___
	Alternatively: Hold the 🅿 button for more than 10 sec after code entry:		
COD1	Possibility of setting the code number for the configuration level(option).1		___
COD2	Possibility of setting the code number for the parameter levels(option). 1		___
LNG	Language selection of the menu text(Deutsch,English,User def, Off)Deutsch		___
CONF	Selection of the configured controller function (*if existent*)		

return to operating mode: *Briefly* press the 🅿 - button

or: **continue** to the following settings: press the 🅿 -button and *hold it* > 5 sec:

Note: when continuing after changing a function, the display first flashes for a
few seconds, only then does the desired switching over or back take place

SPEF	Configuration external/second setpoint "BIN" (activation by binary input)		
	/ "MENU" (activation from the setpoint level) / "SP2" / "AUS"=OFF	MENU	___
AIN*	Input type for input no.*: "RTD / 0-20 / 4-20(mA) / 0-10 / 2-10(V) /	*RTD*	___
	AUS=OFF" (note different terminals for I/U!)**		
IST*	Correction value for changing the controller display (+/-)	*0.0*	___
SP 2/E	Type of effect of second / external setpoint: "Add/ Sub/ AbS"	AbS	___
	(adding / subtracting / absolute value)		
*YM	Setting time of the controlled drive "6…600" (sec)	*60 sec*	___
*CY' '	Switching frequency in two-point controllers: "2...120" (sec.)	*20 sec*	___
*OUT	Setting output signal "0...20 / 4...20" (mA) /0...10 / 2...10 (V)"	*4...20 mA*	___
*OUT	Setting output characteristic: direct / inverse "di / in"	*in*	___
	(with 2 outputs: "in in / in di / di in / di di")	*inin*	___
*td	For 2 outputs: dead zone between outputs 1 and 2 "0…10%"	*0*	___
*AP	Output signal working point (-100…+100)	*50*	___
FG A/E	Automatic adjustment of remote transmitter input (see extra sheet 99ar)		
Sou*	Assignment of inform. output signal(s)* (act. value/setp., setting var..)	*Ist1*	___
Sou*	Type of information output signal(s)* "0..20/4..20(mA)/0..10/2..10(V)"	*4..20 mA*	___
	(* Sout= Signal 1; Sou2 = Signal 2)		
*Y_S	Behaviour of the setting output in the event of measurement line error:		
	Relay position: "rel1 / rel2 / OFF"	*rel2(70.),rel1(20.)*	___
	Continuous output: "0...100" (%)	*0*	___
bin. Eing	Sub-menu for binary input configurations		
	Polling: press the 🅿 -button and *hold it* > 5 sec:		
BIN*	Direction of control action binary input* direct / inverse (di/in)	di	___
BIN*	Assignment of collective relay: Stat=none, SREL= collective relay	stat	___
BIN*	Switch-on delay (0…300 sec)	0	___
REL*	Function mode of additional contact (relay no.)	So*A*(701),St*A*(201)	___
REL*	Measuring input / control loop assigned to additional contact	*Ist 1*	___
REL*	Add. contact – relay pos. in event of meas. line error "SiE/SiA"(on/off)	*Si A*	___
Adr	if equipped with interface: bus address (number)	*5*	___
BAUD	if equipped with interface: baudrate (9600/19200/38400)	38400	___

**return** to operating mode: briefly press the 🅿 - button *again*

* = ID number in case of several inputs / outputs or control loops.
** = Rtd input of ain2 is additionally usable if equipped with ext. setpoint and activation using SP-F.

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Selectable switching functions (depending on version)**:**
*For setting please refer to configuration level under „reL..."*

Switching functions for *trailing* contacts:

LC A   Break contact on either side of setpoint
(**L**imit **c**omparator). Relay drops out as
deviation increases (**A**us = off)

LC E   Make contact on either side of setpoint
(**L**imit **c**omparator). Relay picks up as
deviation increases (**E**in = on)

Su A   Break contact below setpoint. Relay drops
out as actual value decreases (**A**us = off)

Su E   Make contact below setpoint. Relay picks
up as actual value decreases (**E**in = on)

So A   Break contact above setpoint. Relay drops
out as actual value increases (**A**us = off)

So E   Make contact above setpoint. Relay picks
up as actual value increases (**E**in = on)

St A   Heating stage below setpoint. Relay
drops out as actual value increases
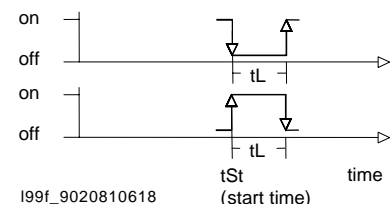(**A**us = off)
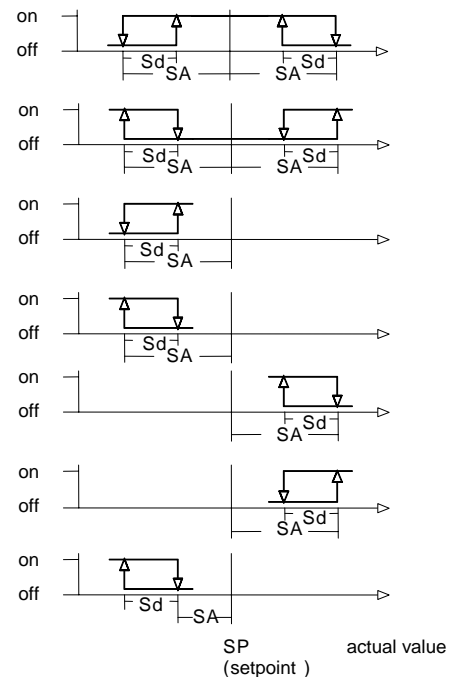
Switching functions for *independent* contacts:

US A   Relay drops out with increasing actual
value (**A**us = off)

US E   Relay picks up with increasing actual
value (**E**in = on)
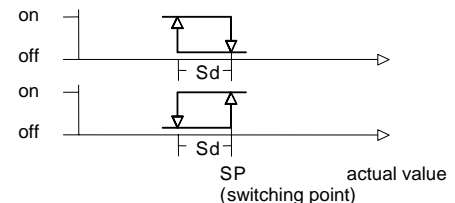
Switching functions for *time dependent* contacts*:*

RTCA   time dependent switch-off contact(**A**us=off)

RTCE   time dependent switch-on contact (**E**in= on)

I99f_9020810618

Service function:

Ein/Aus contact is constantly switched on (**Ein**) or off (**Aus**) respectively

Special function:

SF6   as SoA but switching point at setpoint, control output around SA below

In each case additional settings follow under "rEL." after the selection is acknowledged (P key)
        (depending on version):

Ist./ Y   assigned value: actual value no. ... or Y (actuating signal)

CH../.SP.(only) for trailing contacts: assigned control circuit / channel (no.) or
        assigned setpoint (1SP., rSP, SP.1, ..)
        for independent contacts: assignment of parameter input (channel no..)

        "Safety" shut down (in case of measuring line fault):
SI E   Relay for "Safety" behaviour in event of measuring circuit error: relay **on**
SI A   Relay for "Safety" behaviour in event of measuring circuit error: relay **off**

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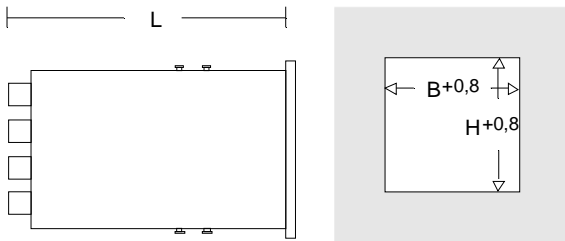**Characteristics:** *(parameters dep. on sub type:)*
Adjustment on parameter level, code locked,
pre adjusted on customer´s demand.
Proportional band Xp: 0,1...999,9 %
Integral action time Tn: 0,0...999,9 min
Rate time Tv: 0,0...99,9 min
Sensitivity of response Xsh: 0,1...1,0 %
Travel time of the actuator Tm: 6...600 sec
Switching frequency cy: 2...120 sec
Function characteristics: direct / inverted
Switching interval SA (add. contacts): 0..100,0 K
Switching difference Sd: 0,1...100,0 K
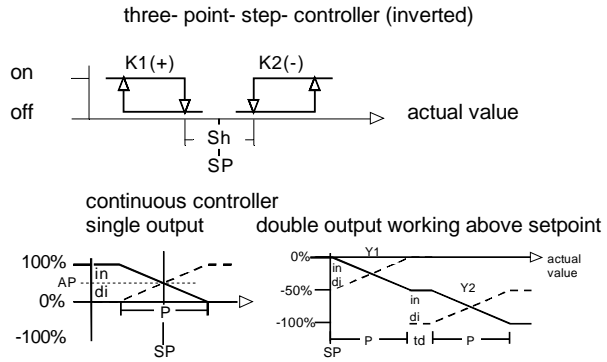
Additional contact functions:
As switching interval above and below setpoint or
independent adjustable with own setpoint and
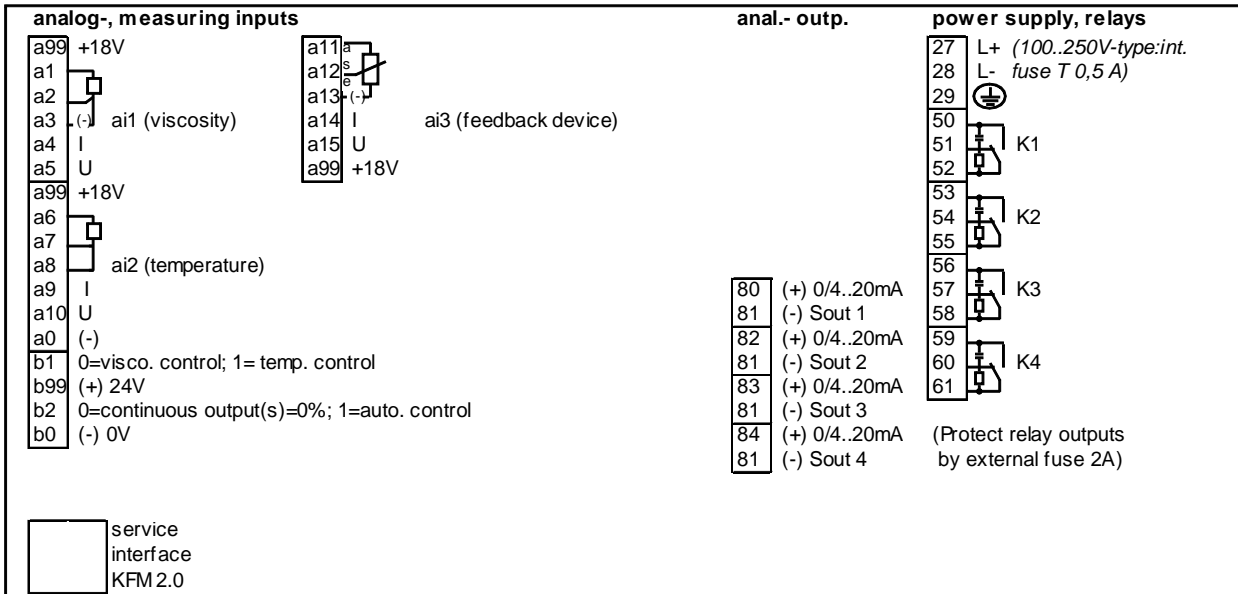measuring input, switching function adjustable

Installation dimensions:

Form 96x96: L=150mm, B=92mm, H=92mm

three- point- step- controller (inverted)

continuous controller
single output   double output working above setpoint

Other data:
Housing for panel mounting, 96 x 96 mm
Installation orientation: optional
Power supply: 100..250 VAC, about 14 VA
alternative 24 V AC / DC
Protective system EN 60529: IP54 (terminals IP20)
Permissible ambient temperature: 0...60°C
Nominal temperature: 20°C
Climatic category: KWF to EN 60529
Relative humidity <= 75 % yearly average,
no condensation
EMC: referring to EN 61326

Wiring diagram: (Example, valid for each delivered controller is the wiring diagram on its casing only)

analog-, measuring inputs

a99	+18V
a1	
a2	
a3	(-) ai1 (viscosity)
a4	I
a5	U
a99	+18V
a6	
a7	
a8	ai2 (temperature)
a9	I
a10	U
a0	(-)
b1	0=visco. control; 1= temp. control
b99	(+) 24V
b2	0=continuous output(s)=0%; 1=auto. control
b0	(-) 0V

a11	a
a12	s e
a13	(-)
a14	I ai3 (feedback device)
a15	U
a99	+18V

anal.- outp.

80	(+) 0/4..20mA
81	(-) Sout 1
82	(+) 0/4..20mA
81	(-) Sout 2
83	(+) 0/4..20mA
81	(-) Sout 3
84	(+) 0/4..20mA
81	(-) Sout 4

power supply, relays

27	L+ *(100..250V-type:int.*
28	L- *fuse T 0,5 A)*
29	⏚
50	
51	K1
52	
53	
54	K2
55	
56	
57	K3
58	
59	
60	K4
61	

(Protect relay outputs
by external fuse 2A)

service
interface
KFM 2.0

Wiring, examples for input 1 and output 1 respectively:

Pt100

a1	
a2	3-wire
a3	

a1	
a2	2-wire
a3	

standard signal

(-)	a3	0/4..20mA
(+)	a4	
(-)	a4	4..20mA
(+)	a99	2-wire-Tr.
(-)	a3	0/2..10V
(+)	a5	

a1	
a2	feedback device
a3	

binary inputs

b99	pot.free
b1	contact

b1	external
b0	voltage. 24V

Wiring
example
actuator

open	50
	51
M	52
close	53
	54
N L	55